PATENT ABSTRACTS OF JAPAN

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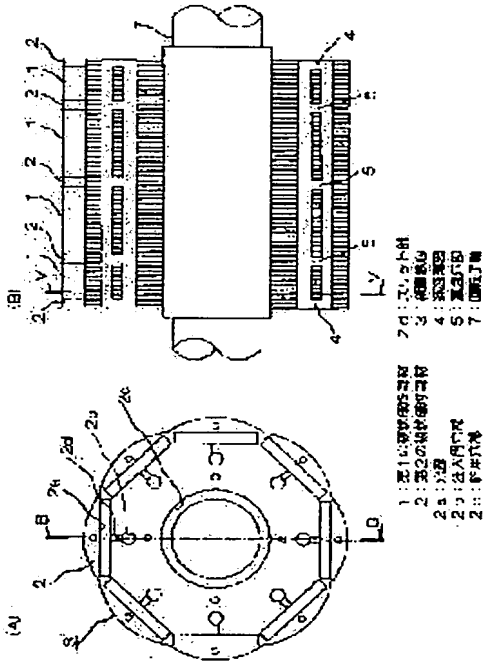
(54) MAGNET EMBEDDED ROTOR

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a magnet embedded rotor capable of improving reliability thereof.
SOLUTION: This magnet embedded rotor comprises a laminated core 3 formed by laminating plate-shaped magnetic members, a plurality of holes 2a, (1a) drilled in the vicinity of the outer periphery of the laminated core 3 with prescribed intervals in the circumferential direction and in the axial direction, a plurality of permanent magnets inserted into the respective holes 2a, (1a), a plurality of holes 2b, (1b) for injection drilled along the central side of the laminated core 3 at the respective holes 2a, (1a) in the axial direction respectively and formed by making communication with holes 2a, (1a) at the positions corresponding to the permanent magnets, communicating groove parts 4 formed at both end surfaces of the laminated iron core 3 by making communication respectively between the holes 2a, (1a) and the holes 2b, (1b) for injection, and a resin member 8 injected into the holes 2a, (1a) through the holes 2b, (1b) for injection and the communicating grooves 4, with a clearance partly left on the central side of the axis of a permanent magnet 6.



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CLAIMS

[Claim(s)]
[Claim 1] The layer-built iron core formed by carrying out the laminating of the tabular magnetism member, and two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of the above-mentioned layer-built iron core, Two or more holes for impregnation which are open for free passage with the above-mentioned hole, and are formed in the location which penetrates to shaft orientations along with two or more permanent magnet side fitted in each above-mentioned hole, respectively, and the core side of the above-mentioned layer-built iron core of each above-mentioned hole, respectively, and corresponds with the above-mentioned permanent magnet, The free passage slot which opens between the above-mentioned hole and the above-mentioned holes for impregnation for free passage to the both-ends side of the above-mentioned layer-built iron core, respectively, and is formed in it, The magnet flush type rotator characterized by having the resin member with which is poured in through the above-mentioned hole for impregnation, and the above-mentioned free passage slot, and leaves space in part and the shaft center side of the above-mentioned permanent magnet is loaded into the above-mentioned hole.
[Claim 2] The resin member poured in through a free passage slot is a magnet flush type rotator according to claim 1 characterized by being projected and loaded from the end face of a layer-built iron core.
[Claim 3] The resin member with which it is projected and loaded from the end face of a layer-built iron core is a magnet flush type rotator according to claim 2 characterized by connecting the comrades which adjoin each other, respectively and being formed annularly in the location by the side of the hoop direction both ends of each hole.
[Claim 4] The layer-built iron core formed by carrying out the laminating of the tabular magnetism member, and two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of the above-mentioned layer-built iron core, Two or more holes for impregnation which are open for free passage with the above-mentioned hole, and are formed in the location which penetrates to shaft orientations along with two or more permanent magnet side fitted in each above-mentioned hole, respectively, and the core side of the above-mentioned layer-built iron core of each above-mentioned hole, respectively, and corresponds with the above-mentioned permanent magnet, The magnet flush type rotator characterized by having the resin member with which is poured in through the end-face top which met the above-mentioned hole from the above-mentioned hole for impregnation, and the above-mentioned hole for impregnation of the both ends of the above-mentioned layer-built iron core, and leaves space in part and the shaft center side of the above-mentioned permanent magnet is loaded into the above-mentioned hole.
[Claim 5] The resin member with which it is loaded on the end face of a layer-built iron core is a magnet flush type rotator according to claim 4 characterized by connecting the comrades which adjoin each other, respectively and being formed annularly in the location by the side of the hoop direction both ends of each hole.
[Claim 6] A resin member is a magnet flush type rotator according to claim 1 to 5 characterized

by being thermosetting resin.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the structure for the hole prepared in the periphery section of a layer-built iron core being equipped with two or more permanent magnets, and starting the magnet flush type rotator which functions as a rotator of a dynamo-electric machine, especially fixing a permanent magnet in a hole.
[0002]
[Description of the Prior Art] As this kind of a conventional magnet flush type rotator, as shown, for example in JP,9-163649,A, the thing which was established for the permanent magnet in the layer-built iron core and which pierce and is fixed in a hole is proposed by arranging the adhesion sheet which sank in or applied adhesives to the periphery section of a permanent magnet. However, it sets to the above flush type rotators. Since the adhesion sheet which sank in or applied adhesives to the periphery section of a permanent magnet is arranged Since there was a trouble of the location of the permanent magnet in each blanking hole having not been fixed, and magnetic properties and weight balance having worsened, and causing performance degradation According to Japanese Patent Application No. No. 336976 [11 to] for which the same applicant as this application applied By penetrating to shaft orientations along with the core side of the layer-built iron core of a hole where a permanent magnet is fitted in, forming a hole and the hole for impregnation open for free passage in a permanent magnet and a corresponding location, and being filled up with a resin member between a hole and a permanent magnet through this hole for impregnation It has proposed certainly fixing a permanent magnet with sufficient balance.
[0003]
[Problem(s) to be Solved by the Invention] Since the conventional magnet flush type rotator was constituted as mentioned above, it was filled up with resin in the hole in which a permanent magnet is fitted and he was trying to fix a permanent magnet with this resin, in order that the pressure for pouring in a resin member might be applied all over a permanent magnet and the big force might act on a layer-built iron core, there was a trouble that there was fear of being damaged by the amount of thin-walled part.
[0004] It reduces the pressure applied to a layer-built iron core at the time of impregnation of a resin member, and aims at offering the magnet flush type rotator which can aim at improvement in dependability while this invention was made in order to cancel the above troubles, and it certainly fixes a permanent magnet with sufficient balance.
[0005]
[Means for Solving the Problem] The magnet flush type rotator concerning claim 1 of this invention The layer-built iron core formed by carrying out the laminating of the tabular magnetism member, and two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of a layer-built iron core, Two or more holes for impregnation which are open for free passage with a hole, and are formed in the location which penetrates to shaft orientations along with the core side of two or more permanent magnets fitted in each hole, respectively, and the layer-built iron core of each hole,

respectively, and corresponds with a permanent magnet, It is poured in through the free passage slot which opens between a hole and the holes for impregnation for free passage to the both-ends side of a layer-built iron core, respectively, and is formed in it, and the hole for impregnation and a free passage slot, and has the resin member with which leaves space in part and the shaft center side of a permanent magnet is loaded into a hole.

[0006] Moreover, in claim 1, the resin member poured in through a free passage slot is projected from the end face of a layer-built iron core, and the magnet flush type rotator concerning claim 2 of this invention loads with it.

[0007] Moreover, in claim 2, the magnet flush type rotator concerning claim 3 of this invention makes the comrades which adjoin each other in the location by the side of the hoop direction both ends of each hole, respectively in the resin member with which it is projected and loaded from the end face of a layer-built iron core connect, and is formed annularly.

[0008] Moreover, the magnet flush type rotator concerning claim 4 of this invention The layer-built iron core formed by carrying out the laminating of the tabular magnetism member, and two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of a layer-built iron core, Two or more holes for impregnation which are open for free passage with a hole, and are formed in the location which penetrates to shaft orientations along with the core side of two or more permanent magnets fitted in each hole, respectively, and the layer-built iron core of each hole, respectively, and corresponds with a permanent magnet, It is poured in through the end-face top which met the hole from the hole for impregnation, and the hole for impregnation of the both ends of a layer-built iron core, and has the resin member with which leaves space in part and the shaft center side of a permanent magnet is loaded into a hole.

[0009] Moreover, in claim 4, the magnet flush type rotator concerning claim 5 of this invention makes the comrades which adjoin each other in the location by the side of the hoop direction both ends of each hole, respectively in the resin member with which it is loaded on the end face of a layer-built iron core connect, and is formed annularly.

[0010] Moreover, the magnet flush type rotator concerning claim 6 of this invention uses a resin member as thermosetting resin in claim 1 thru/or either of 5.

[0011]

[Embodiment of the Invention] The gestalt of implementation of this invention is explained based on drawing below gestalt 1. of operation. The perspective view showing the appearance of a magnet flush type rotator [in / in drawing 1 / the gestalt 1 of implementation of this invention], Drawing 2 shows the configuration of the magnet flush type rotator in drawing 1 . (A) A front view, The sectional view showing the cross section where (B) meets line B-B in (A), the sectional view showing the cross section where drawing 3 meets line III-III in drawing 2 , Drawing 4 shows the configuration of the layer-built iron core of the magnet flush type rotator in drawing 1 . (A) A front view, The sectional view showing the cross section where (B) meets line B-B in (A), the sectional view showing the cross section where drawing 5 meets line V-V in drawing 4 , and drawing 6 are sectional views shown where the configuration of the impregnation metal mold applied to manufacture of the magnet flush type rotator in drawing 1 is fitted in a layer-built iron core.

[0012] Two or more hole 1a by which 1 is arranged through predetermined spacing in drawing in the hoop direction near the periphery, Hole 1for impregnation b arranged in the hoop direction center section by the side of the core of the layer-built iron core which each [these] hole 1a mentions later, And the 1st tabular magnetism member in which shaft hole section 1c arranged in a core was formed, respectively, 2d of slit sections which open between the hole 2a as each holes 1a, 1b, and 1c of this 1st tabular magnetism member 1 with 2 [same], hole 2b for impregnation, shaft hole section 2c and hole 2a, and hole 2bs for impregnation for free passage is the 2nd tabular magnetism member formed, respectively.

[0013] In and the both ends of a layer-built iron core and permanent magnet which are mentioned later, and the location which corresponds, respectively For example, the laminating of the 2nd tabular magnetism member 2 is carried out in about 3-4 sheets and the combination

which has arranged the 1st tabular magnetism member 1 in the remaining location, respectively. Into the part by which the layer-built iron core 3 was constituted, and the 2nd tabular magnetism member 2 has been arranged by making each hole 1a, 2a and 1b, 2b, and 1c and 2c in agreement, respectively, for example, extracting, and carrying out fixing unification by a caulking etc., by 2d of each slit section The free passage slot 4 and the free passage hole 5 which have the depth and the path for 3 - 4 time of board thickness are formed.

[0014] The permanent magnet which 6 made the pair to both the holes 1a and 2a, and was fitted in, and 7 Both shaft hole section 1c, The rotor axis by which fitting was carried out to 2c, and 8 are resin members which become with the thermosetting resin with which was poured in from each hole 1for impregnation b, and 2b, and was injected into each holes 1a and 2a through the free passage slot 4 and the free passage hole 5, and left space in part and the shaft center side of each permanent magnet 6 was loaded. As 9 is the impregnation metal mold for pouring the resin member 8 into a layer-built iron core 3 and it is shown in drawing 5 , resin supply hole 10a, In each hole 1for impregnation b of a layer-built iron core 3, 2b, and a corresponding location from branching hole 10b which branches from this resin supply hole 10a, and this branching hole 10b The punch 10 which has 10d of heights which can contact the end face of the permanent magnet 6 in two or more impregnation hole 10c by which opening is carried out, respectively and each hole 1a of a layer-built iron core 3, and 2a, It protrudes on each holes 1a and 2a of the layer-built iron core 3 of the pars basilaris ossis occipitalis of closed-end hole section 11a which can fit in a layer-built iron core 3, and this closed-end hole section 11a, and a corresponding location, respectively, and consists of female mold 11 which has height 11b which can contact the end face of the permanent magnet 6 in each hole 1a and 2a.

[0015] Next, the manufacture approach of the magnet flush type rotator in the gestalt 1 of the implementation constituted as mentioned above is explained. First, the 2nd tabular magnetism member 2 which has the 1st tabular magnetism member 1 which has hole 1a, hole 1for impregnation b, and shaft hole section 1c by punching processing and hole 2a, hole 2b for impregnation, shaft hole section 2c, and 2d of slit sections is formed, respectively. Subsequently, as shown in drawing 4 , while arranging the 2nd 3-4 tabular magnetism members 2, respectively in the location equivalent to the both ends of a layer-built iron core 3, and each each permanent magnet 6 and corresponding location The 1st tabular magnetism member 1 is arranged into the remaining part, a laminating is carried out so that each other Holes 1a and 2a, hole 1for impregnation b, 2b, and the shaft hole sections 1c and 2c may be in agreement, respectively, for example, it extracts, fixing unification is carried out by a caulking etc., and a layer-built iron core 3 is formed.

[0016] Next, the layer-built iron core 3 formed as mentioned above is fitted in into closed-end hole section 11a of female mold 11 so that each hole 2a may be in agreement with each height 11b, as shown in drawing 5 . subsequently, the inside of each hole 1a of a layer-built iron core 3, and 2a -- respectively -- a permanent magnet 6 -- every [predetermined / the number] -- it inserts. And although each impregnation hole 10c lays in the upper part of female mold 11 so that the location and 10d of each height of each hole 2b for impregnation of a layer-built iron core 3 may be in agreement with the location of each hole 2a of a layer-built iron core 3, respectively, and it does not carry out illustration, after it binds a punch 10 and female mold 11 tight by the fastening part and it makes a punch 10 fix, the resin member 8 is poured in from resin supply hole 10a with a predetermined pressure.

[0017] This resin member 8 Then, branching hole 10b of a punch 10, each impregnation hole 10c, and each hole 1for impregnation b of a layer-built iron core 3, Where it was led in each hole 1a and 2a through each free passage hole 5 formed of slit section 2b as it flowed in order and the inside of 2b was shown in drawing 2 and drawing 3 , and it pressed each permanent magnet 6 to the periphery side and space is left to a shaft center side in part Moreover, it is led in each hole 1a and 2a through each free passage slot 4 formed in the both ends of a layer-built iron core 3 of slit section 2b, and where a permanent magnet 6 is pressed from the both-sides side, it fills up, respectively. Next, by heating in this condition, the resin member 8 is stiffened and it unifies in a layer-built iron core 3. Subsequently, a fastening part (not shown) is loosened, a

punch 10 is removed, and a magnet flush type rotator is completed by taking out a layer-built iron core 3 from female mold 11, carrying out fitting of the rotor axis 7 to the shaft hole sections 1c and 2c, and fixing.

[0018] According to the gestalt 1 of the above-mentioned implementation, each free passage slot 4 and the free passage hole 5 which are formed of 2d of slit sections in the resin member 8 are minded. Thus, each hole 1a, Since he is trying to load, respectively in the condition of having pressed from the condition which led in 2a, pressed the permanent magnet 6 to the periphery side, and left space in part to the shaft center side, and the both-sides side of a permanent magnet 6, a permanent magnet 6 can certainly be fixed with sufficient balance, and it becomes possible to aim at improvement in dependability.

[0019] Moreover, since he is trying to form space in the shaft center side of each permanent magnet 6 in part by drawing the resin member 8 in each hole 1a and 2a from both the free passage slot 4 and the free passage hole 5 It becomes possible to prevent being able to reduce the force applied to a layer-built iron core 3 by the range in which this space is formed, and the excessive force being applied to a layer-built iron core 3, and being damaged by the amount of thin-walled part. It enables it for the unification with a layer-built iron core 3 to become easy, and to aim at improvement in assembly-operation nature by having used the resin member 8 as thermosetting resin further again.

[0020] The perspective view showing the appearance of a magnet flush type rotator [in / in gestalt 2. drawing 7 of operation / the gestalt 2 of implementation of this invention], Drawing 8 R> 8 shows the configuration of the magnet flush type rotator in drawing 7 . (A) A front view, It is the sectional view in which (B's) showing the configuration of the layer-built iron core of a magnet flush type rotator [in / in the sectional view and drawing 9 which show the cross section in alignment with line B-B in (A) / drawing 7], and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]

[0021] In drawing, also in the gestalt 1 of the above-mentioned implementation, the same part attaches the same sign and omits explanation. 12 the 2nd tabular magnetism member 2 with about 1-2 sheets and each permanent magnet 6 in the location corresponding to both ends for the 2nd tabular magnetism member 2 About 3-4 sheets, Moreover, it is the layer-built iron core which carry out a laminating to the remaining location in the combination which has arranged the 1st tabular magnetism member 1, respectively, and each hole 1a, 2a and 1b, 2b, and 1c and 2c are made in agreement, respectively, extracts, and is formed by carrying out fixing unification by a caulking etc.

[0022] 13 and 14 by 2d of each slit section into the part by which the 2nd tabular magnetism member 2 has been arranged, respectively The depth of 1 - 2 double part of board thickness, And the free passage slot and free passage hole which were formed in the path for 3 - 4 time of board thickness, It is the resin member which becomes with the thermosetting resin with which 15 was poured in from each hole 1for impregnation b, and 2b, and was injected into each holes 1a and 2a through the free passage slot 13 and the free passage hole 14, and left space in part and the shaft center side of each permanent magnet 6 was loaded. The comrades which adjoin the method of outside [end face / of a layer-built iron core 12] in the location by the side of a projection and the hoop direction both ends of each hole 2a, respectively by work of the slot (not shown) formed in the punch 10 and female mold 11 of the impregnation metal mold 9 are connected, and the part with which it is loaded through the free passage slot 13 is formed annularly.

[0023] According to the gestalt 2 of the above-mentioned implementation, each free passage slot 13 and the free passage hole 14 which are similarly formed of 2d of slit sections in the resin member 15 in the gestalt 1 of the above-mentioned implementation are minded. Thus, each hole 1a, Since he is trying to load, respectively in the condition of having pressed from the condition which led in 2a, pressed the permanent magnet 6 to the periphery side, and left space in part to the shaft center side, and the both-sides side of a permanent magnet 6, a permanent magnet 6 can certainly be fixed with sufficient balance, and it becomes possible to aim at improvement in dependability.

[0024] Moreover, since he is trying to form space in the shaft center side of each permanent magnet 6 in part by drawing the resin member 15 in each hole 1a and 2a from both the free passage slot 13 and the free passage hole 14 It becomes possible to prevent being able to reduce the force applied to a layer-built iron core 12 by the range in which this space is formed, and the excessive force being applied to a layer-built iron core 12, and being damaged by the amount of thin-walled part. Moreover, it enables it for the unification with a layer-built iron core 12 to become easy, and to aim at improvement in assembly-operation nature by having used the resin member 15 as thermosetting resin.
[0025] Moreover, since he is trying to lead into each hole 1a and 2a through the slot (not shown) and the free passage slot 13 which were formed in the punch 10 and female mold 11 of the impregnation metal mold 9 from the both-ends side of a layer-built iron core 12 The number of sheets of the 2nd tabular magnetism member 2 arranged in order that only the part using a slot (not shown) may form the depth 13 of the free passage slot 13, i.e., a free passage slot, can be reduced, and reduction of the cost price can be aimed at. Since the comrades which adjoin each other further again in the location by the side of the hoop direction both ends of each hole 2a, respectively in the resin member 15 which projects from the both-ends side of a layer-built iron core 12 are made to connect and it is annular, improvement in a mechanical strength can be aimed at.
[0026] The perspective view showing the appearance of a magnet flush type rotator [in / in gestalt 3. drawing 10 of operation / the gestalt 3 of implementation of this invention], Drawing 11 shows the configuration of the magnet flush type rotator in drawing 10 . (A) A front view, It is the sectional view in which (B's) showing the configuration of the layer-built iron core of a magnet flush type rotator [in / in the sectional view and drawing 12 which show the cross section in alignment with line B-B in (A) / drawing 10], and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view] In drawing, also in the gestalten 1 and 2 of the above-mentioned implementation, the same part attaches the same sign and omits explanation. 16 is a layer-built iron core which carry out the laminating of the 2nd tabular magnetism member 2 in each permanent magnet 6 and a corresponding location in about 3-4 sheets and the combination which has arranged the 1st tabular magnetism member 1 in the remaining location, respectively, and each hole 1a, 2a and 1b, 2b, and 1c and 2c are made in agreement, respectively, extracts, and is formed by carrying out fixing unification by a caulking etc.
[0027] The free passage hole by which 17 was formed in the part by which the 2nd tabular magnetism member 2 has been arranged of 2d of each slit section at the path for 3 - 4 time of board thickness, 18 is poured in from each hole 1for impregnation b, and 2b, and the slot (not shown) formed in the punch 10 of the free passage hole 17 and the impregnation metal mold 9 and female mold 11 is minded. Each hole 1a, By the resin member which becomes with the thermosetting resin with which was poured into 2a, and left space and the shaft center side of each permanent magnet 6 was loaded in part The comrades which adjoin each other, respectively are connected and the part with which it is loaded through a slot (not shown) is annularly formed in the method of outside [end face / of a layer-built iron core 16] in the location by the side of a projection and the hoop direction both ends of each hole 1a.
[0028] According to the gestalt 3 of the above-mentioned implementation, also in the gestalt 2 of the above-mentioned implementation thus, similarly Improvement in dependability is aimed at by certainly fixing a permanent magnet 6 with sufficient balance. Moreover, by preventing reducing the force applied to a layer-built iron core 16 by forming space in the shaft center side of each permanent magnet 6 in part, and the excessive force being applied, and being damaged by the amount of thin-walled part, and using thermosetting resin as a resin member 18 That it becomes possible to aim at improvement in assembly-operation nature, using the unification with a layer-built iron core 16 as easy, of course Since only the slot (not shown) formed in the punch 10 and female mold 11 of metal mold 9 is made to perform installation from the layer-built iron core 16 both-ends side of the resin member 18 to into each hole 1a and 2a The 2nd tabular magnetism member 2 arranged in order that the free passage slot [as / in the gestalt 2

of the above-mentioned implementation] 13 may form needlessness 13, i.e., a free passage slot, becomes completely unnecessary, and a large cost reduction becomes possible. In addition, the end face of the layer-built iron core 16 of a punch 10 and female mold 11 and the whole field which counters, respectively are hollowed instead of the slot formed in the punch 10 and female mold 11 of metal mold 9, you may make it load with the resin member 18 through the inside of the space formed of this hollow, and it cannot be overemphasized that it is projected and formed in this case so that the resin member 18 may cover the both-ends whole region of a layer-built iron core 16.

[0029]

[Effect of the Invention] As mentioned above, the layer-built iron core which was formed by carrying out the laminating of the tabular magnetism member according to claim 1 of this invention, Two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of a layer-built iron core, Two or more holes for impregnation which are open for free passage with a hole, and are formed in the location which penetrates to shaft orientations along with the core side of two or more permanent magnets fitted in each hole, respectively, and the layer-built iron core of each hole, respectively, and corresponds with a permanent magnet, Since it had the resin member with which is poured in through the free passage slot which opens between a hole and the holes for impregnation for free passage to the both-ends side of a layer-built iron core, respectively, and is formed in it, and the hole for impregnation and a free passage slot, and leaves space in part and the shaft center side of a permanent magnet is loaded into a hole While certainly fixing a permanent magnet with sufficient balance, the pressure applied to a layer-built iron core at the time of impregnation of a resin member can be reduced, and the magnet flush type rotator which can aim at improvement in dependability can be offered.

[0030] Moreover, since according to claim 2 of this invention the resin member poured in through a free passage slot is projected from the end face of a layer-built iron core and it loaded with it in claim 1, the magnet flush type rotator as well as the ability to aim at improvement in dependability which can aim at reduction of the cost price can be offered.

[0031] Moreover, since the comrades which adjoin each other in the location by the side of the hoop direction both ends of each hole, respectively in the resin member with which it is projected and loaded from the end face of a layer-built iron core in claim 2 are made to connect and it was made to form annularly according to claim 3 of this invention, the magnet flush type rotator which can aim at reduction of the cost price and improvement in a mechanical strength can be offered.

[0032] Moreover, the layer-built iron core which was formed by carrying out the laminating of the tabular magnetism member according to claim 4 of this invention, Two or more holes formed in the hoop direction by penetrating to shaft orientations through predetermined spacing near the periphery of a layer-built iron core, Two or more holes for impregnation which are open for free passage with a hole, and are formed in the location which penetrates to shaft orientations along with the core side of two or more permanent magnets fitted in each hole, respectively, and the layer-built iron core of each hole, respectively, and corresponds with a permanent magnet, Since it had the resin member with which is poured in through the end-face top which met the hole from the hole for impregnation, and the hole for impregnation of the both ends of a layer-built iron core, and leaves space in part and the shaft center side of a permanent magnet is loaded into a hole, the magnet flush type rotator in which the improvement in dependability and reduction of the cost price are possible can be offered.

[0033] Moreover, since the comrades which adjoin each other in claim 4 in the location by the side of the hoop direction both ends of each hole, respectively in the resin member with which it is loaded on the end face of a layer-built iron core are made to connect and it was made to form annularly according to claim 5 of this invention, of course, that the improvement in dependability and reduction of the cost price are possible can offer the magnet flush type rotator which a mechanical strength can improve.

[0034] Moreover, according to claim 6 of this invention, in claim 1 thru/or either of 5, since the

resin member was used as thermosetting resin, the magnet flush type rotator which can aim at improvement in assembly-operation nature can be offered.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective view showing the appearance of the magnet flush type rotator in the gestalt 1 of implementation of this invention.
[Drawing 2] It is the sectional view in which showing the configuration of the magnet flush type rotator in drawing 1 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Drawing 3] It is the sectional view showing the cross section in alignment with line III-III in drawing 2 .
[Drawing 4] It is the sectional view in which showing the configuration of the layer-built iron core of the magnet flush type rotator in drawing 1 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Drawing 5] It is the sectional view showing the cross section in alignment with line V-V in drawing 4 .
[Drawing 6] It is the sectional view showing the configuration of the impregnation metal mold applied to manufacture of the magnet flush type rotator in drawing 1 in the condition of having been fitted in the layer-built iron core.
[Drawing 7] It is the perspective view showing the appearance of the magnet flush type rotator in the gestalt 2 of implementation of this invention.
[Drawing 8] It is the sectional view in which showing the configuration of the magnet flush type rotator in drawing 7 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Drawing 9] It is the sectional view in which showing the configuration of the layer-built iron core of the magnet flush type rotator in drawing 7 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Drawing 10] It is the perspective view showing the appearance of the magnet flush type rotator in the gestalt 3 of implementation of this invention.
[Drawing 11] It is the sectional view in which showing the configuration of the magnet flush type rotator in drawing 10 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Drawing 12] It is the sectional view in which showing the configuration of the layer-built iron core of the magnet flush type rotator in drawing 10 , and showing the cross section in alignment with line B-B [in / (A) and / in (B) / (A)]. [a front view]
[Description of Notations]
1 1st Tabular Magnetism Member, 2 2nd Tabular Magnetism Member, 1a, 2a Hole, 1b, 2b The hole for impregnation, 1c, 2c The shaft hole section, 2d Slit section, 3, 12, 16 4 A layer-built iron core, 13 A free passage slot, 6 A permanent magnet, 7 A rotor axis, 8, 15, 18 A resin member, 9 Impregnation metal mold, 10 A punch, 11 Female mold, 5, 14, 17 Free passage hole.

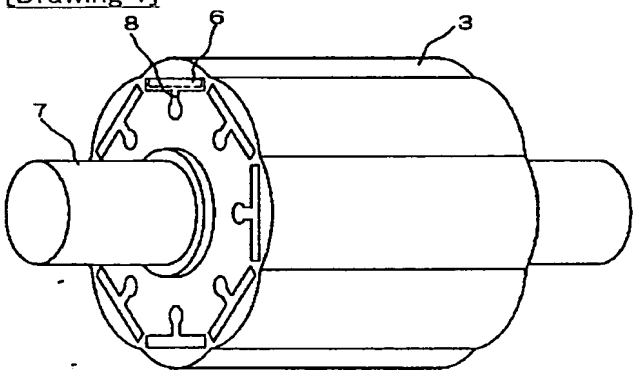
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

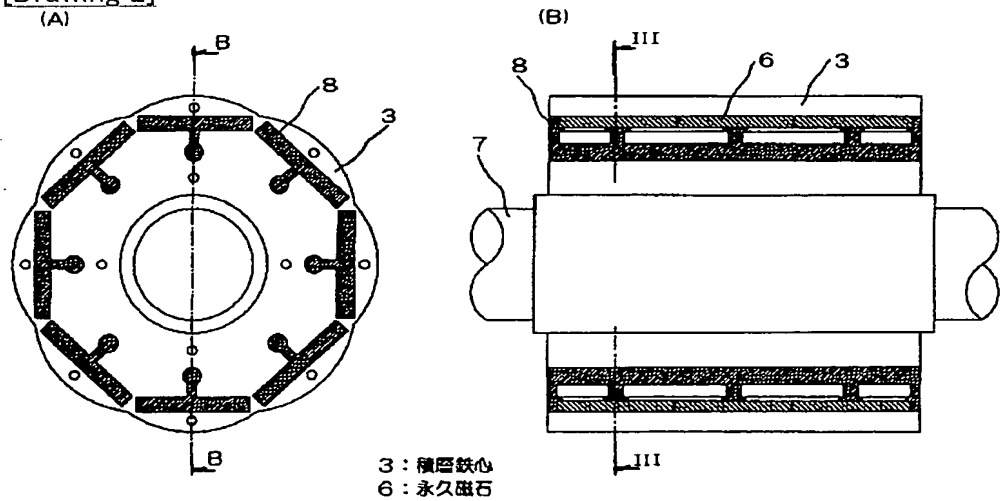
DRAWINGS

[Drawing 1]



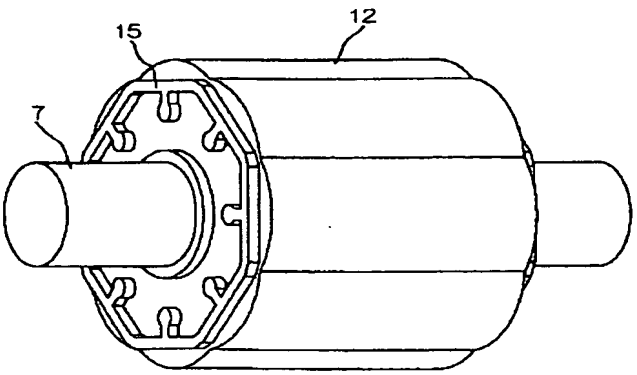
3：積層鉄心
6：永久磁石
7：回転子軸
8：樹脂部材

[Drawing 2]



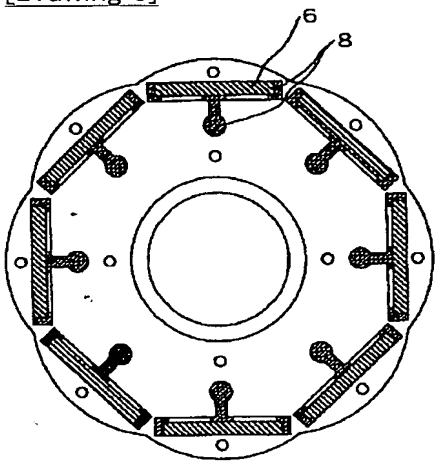
3：積層鉄心
6：永久磁石
7：回転子軸
8：樹脂部材

[Drawing 7]



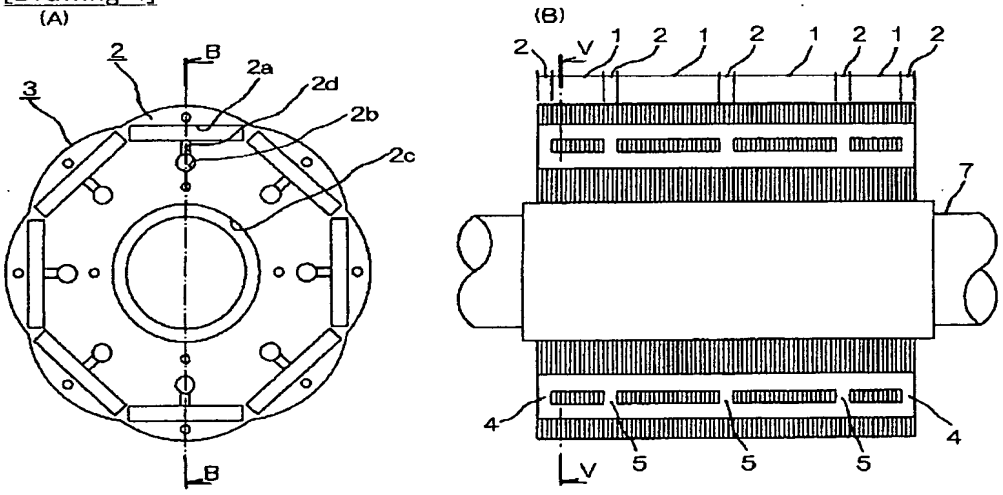
7：回転子軸
12：積層鉄心
15：樹脂部材

[Drawing 3]



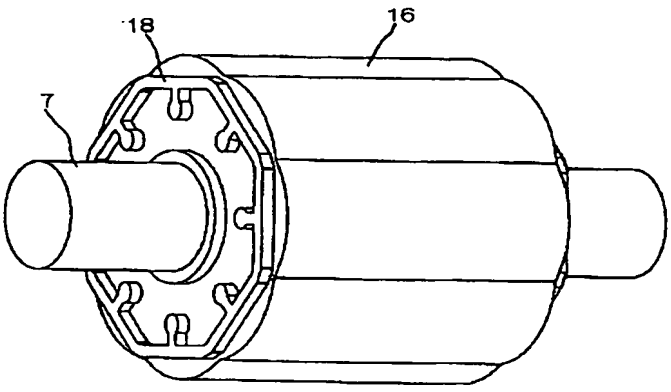
6：永久磁石
8：樹脂部材

[Drawing 4]



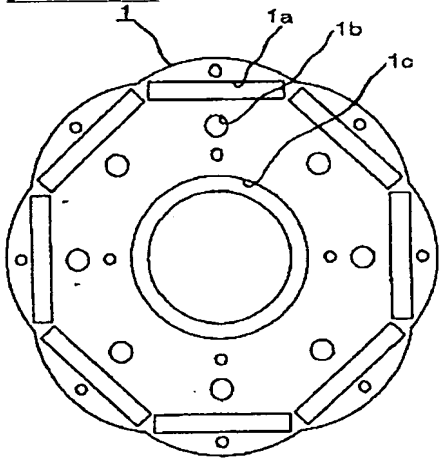
1：第1の板状磁性部材
2：第2の板状磁性部材
2a：穴部
2b：注入用穴部
2c：軸用穴部
2d：スリット部
3：積層鉄心
4：連通溝部
5：連通穴部
7：回転子軸

[Drawing 10]



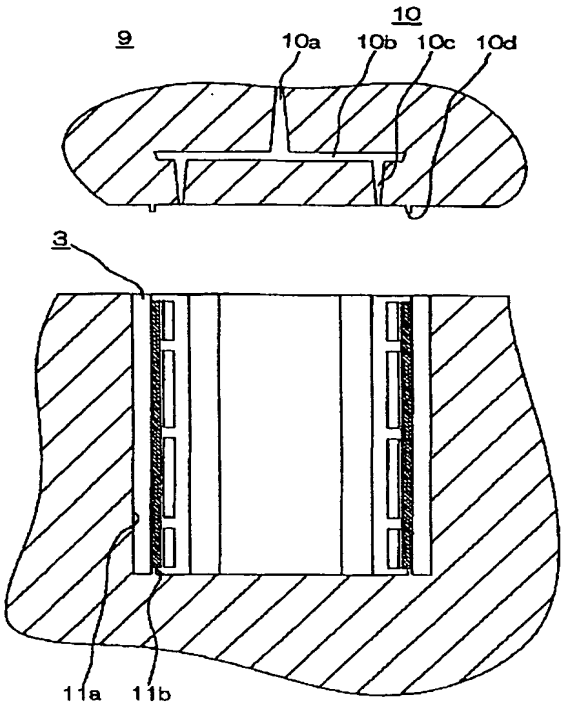
7：回転子軸
16：積層鉄心
18：樹脂部材

[Drawing 5]



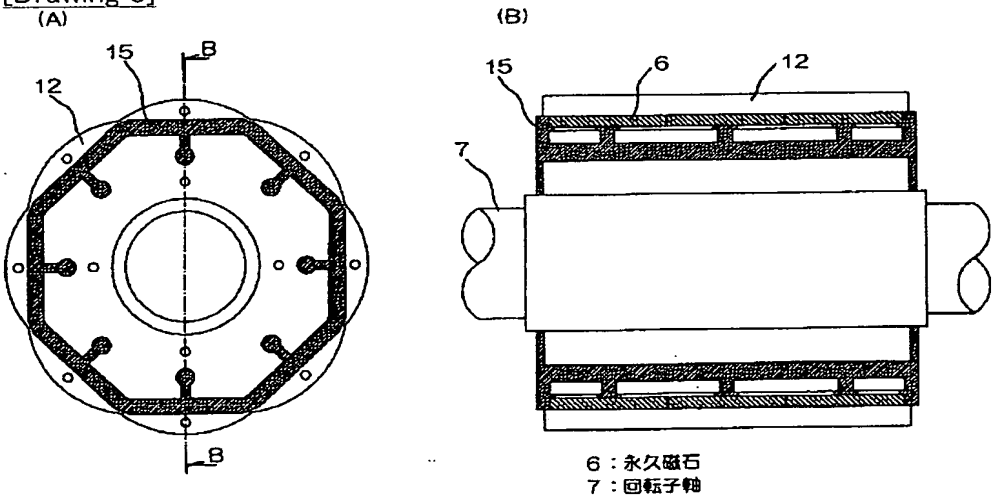
1：第1の板状磁性部材
1a：穴部
1b：注入用穴部
1c：軸用穴部

[Drawing 6]



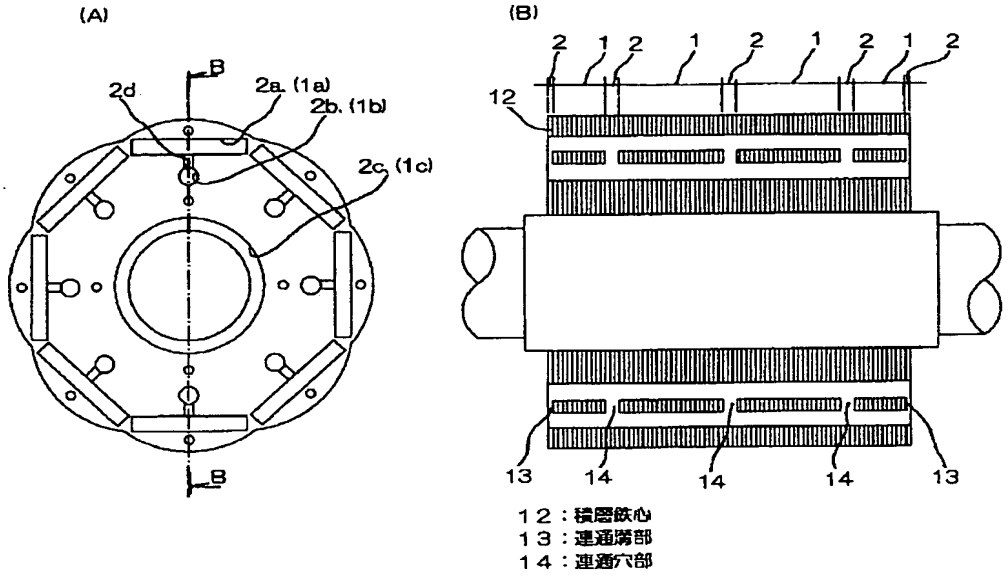
3：積層鉄心
9：注入金型
10：上型
11：下型

[Drawing 8]

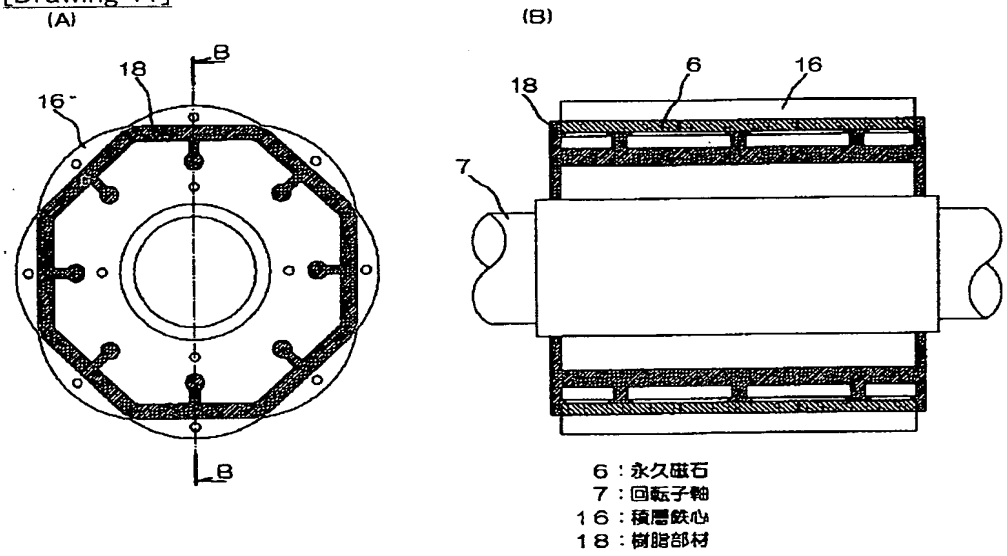


6：永久磁石
7：回転子軸
12：積層鉄心
15：樹脂部材

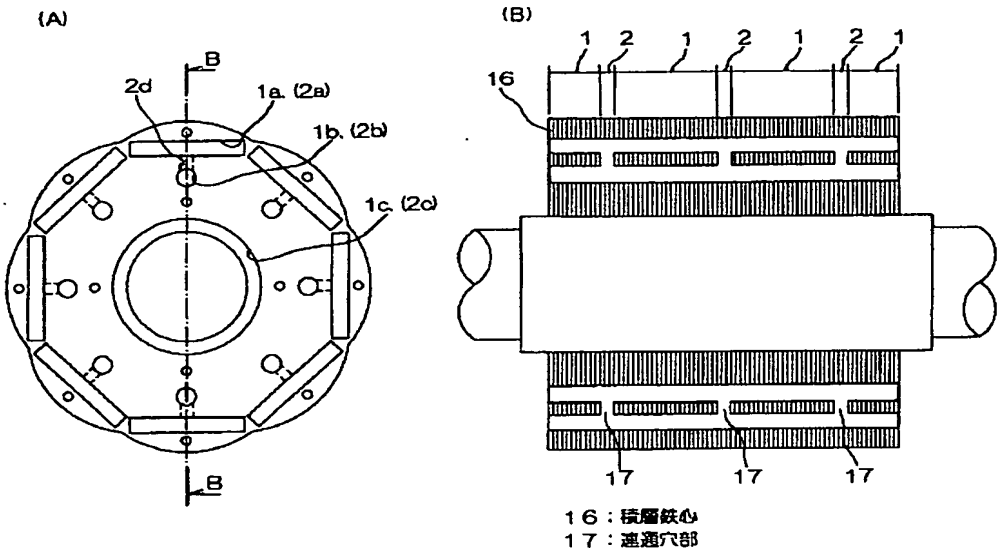
[Drawing 9]



[Drawing 11]



[Drawing 12]



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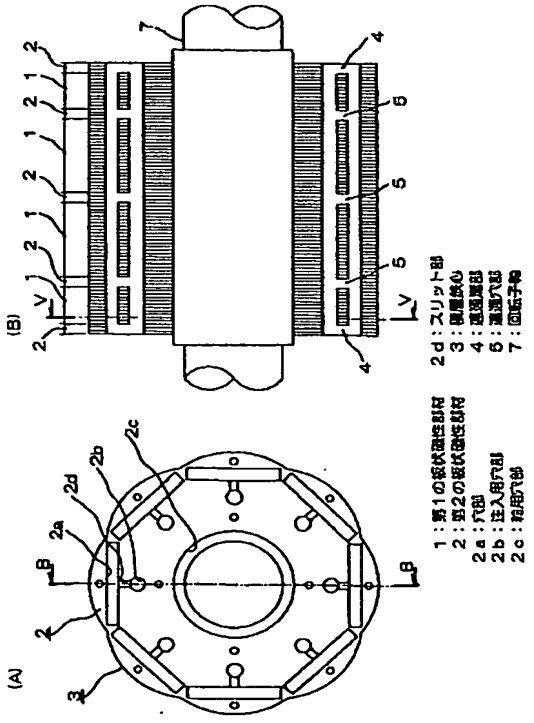
最終頁に続く

(54)【発明の名称】　磁石埋込型回転子

(57)【要約】
【課題】　信頼性の向上を図ることが可能な磁石埋込型回転子を提供する。
【解決手段】　板状磁性部材を積層して形成された積層鉄心３と、積層鉄心３の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部２ａ、（１ａ）と、各穴部２ａ、（１ａ）にそれぞれ嵌挿される複数の永久磁石と、各穴部２ａ、（１ａ）の積層鉄心３の中心側に沿ってそれぞれ軸方向に貫通し永久磁石と対応する位置で穴部２ａ、（１ａ）と連通して形成される複数の注入用穴部２ｂ、（１ｂ）と、積層鉄心３の両端面に穴部２ａ、（１ａ）と注入用穴部２ｂ、（１ｂ）の間をそれぞれ連通して形成される連通溝部４と、注入用穴部２ｂ、（１ｂ）および連通溝部４を介して注入され穴部２ａ、（１ａ）内に永久磁石６の軸中心側に一部空間を残して装填される樹脂部材８とを備える。



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【特許請求の範囲】

【請求項１】　板状磁性部材を積層して形成された積層鉄心と、上記積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、上記各穴部にそれぞれ嵌挿される複数の永久磁石と、上記各穴部の上記積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し上記永久磁石と対応する位置で上記穴部と連通して形成される複数の注入用穴部と、上記積層鉄心の両端面に上記穴部と上記注入用穴部の間をそれぞれ連通して形成される連通溝部と、上記注入用穴部および上記連通溝部を介して注入され上記穴部内に上記永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたことを特徴とする磁石埋込型回転子。

【請求項２】　連通溝部を介して注入される樹脂部材は積層鉄心の端面より突出して装填されていることを特徴とする請求項１記載の磁石埋込型回転子。

【請求項３】　積層鉄心の端面より突出して装填される樹脂部材は各穴部の周方向両端側の位置でそれぞれ隣り合う同士が連結されて環状に形成されていることを特徴とする請求項２記載の磁石埋込型回転子。

【請求項４】　板状磁性部材を積層して形成された積層鉄心と、上記積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、上記各穴部にそれぞれ嵌挿される複数の永久磁石と、上記各穴部の上記積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し上記永久磁石と対応する位置で上記穴部と連通して形成される複数の注入用穴部と、上記注入用穴部および上記積層鉄心の両端部の上記注入用穴部から上記穴部に沿った端面上を介して注入され上記穴部内に上記永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたことを特徴とする磁石埋込型回転子。

【請求項５】　積層鉄心の端面上に装填される樹脂部材は各穴部の周方向両端側の位置でそれぞれ隣り合う同士が連結されて環状に形成されていることを特徴とする請求項４記載の磁石埋込型回転子。

【請求項６】　樹脂部材は熱硬化性樹脂であることを特徴とする請求項１ないし５のいずれかに記載の磁石埋込型回転子。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、積層鉄心の外周部に設けられた穴部に複数の永久磁石が装着され、回転電機の回転子として機能する磁石埋込型回転子に係り、特に永久磁石を穴部内に固定するための構造に関するものである。

【０００２】

【従来の技術】この種の従来の磁石埋込型回転子としては、例えば特開平９－１６３６４９号公報に示されるように、永久磁石の外周部に接着剤を含浸または塗布した接着シートを配することにより、永久磁石を積層鉄心に

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設けられた打抜き穴内に固定することが提案されている。しかしながら、上記のような埋込型回転子においては、永久磁石の外周部に接着剤を含浸または塗布した接着シートを配置しているので、各打抜き穴内における永久磁石の位置が一定せず、磁気特性および重量バランスが悪くなり、性能の低下を招くという問題点があったので、この出願と同一出願人によって出願された特願平１１－３３６９７６号によれば、永久磁石が嵌挿される穴部の積層鉄心の中心側に沿って軸方向に貫通し、永久磁石と対応する位置で穴部と連通する注入用穴部を形成し、この注入用穴部を介して穴部と永久磁石の間に樹脂部材を充填することにより、永久磁石をバランス良く確実に固定することを提案している。

【０００３】

【発明が解決しようとする課題】従来の磁石埋込型回転子は以上のように構成され、永久磁石が嵌挿される穴部内に樹脂を充填し、この樹脂により永久磁石を固定するようにしているので、樹脂部材を注入するための圧力が永久磁石の全面にかかって、積層鉄心に大きな力が作用するため、薄肉部分が損傷する等の恐れがあるという問題点があった。

【０００４】この発明は上記のような問題点を解消するためになされたもので、永久磁石をバランス良く確実に固定するとともに、樹脂部材の注入時に積層鉄心にかかる圧力を低減し、信頼性の向上を図ることが可能な磁石埋込型回転子を提供することを目的とするものである。

【０００５】

【課題を解決するための手段】この発明の請求項１に係る磁石埋込型回転子は、板状磁性部材を積層して形成された積層鉄心と、積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、各穴部にそれぞれ嵌挿される複数の永久磁石と、各穴部の積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し永久磁石と対応する位置で穴部と連通して形成される複数の注入用穴部と、積層鉄心の両端面に穴部と注入用穴部の間をそれぞれ連通して形成される連通溝部と、注入用穴部および連通溝部を介して注入され穴部内に永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたものである。

【０００６】又、この発明の請求項２に係る磁石埋込型回転子は、請求項１において、連通溝部を介して注入される樹脂部材を積層鉄心の端面より突出して装填するようにしたものである。

【０００７】又、この発明の請求項３に係る磁石埋込型回転子は、請求項２において、積層鉄心の端面より突出して装填される樹脂部材を各穴部の周方向両端側の位置でそれぞれ隣り合う同士を連結させて環状に形成するようにしたものである。

【０００８】又、この発明の請求項４に係る磁石埋込型回転子は、板状磁性部材を積層して形成された積層鉄心

と、積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、各穴部にそれぞれ嵌挿される複数の永久磁石と、各穴部の積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し永久磁石と対応する位置で穴部と連通して形成される複数の注入用穴部と、注入用穴部および積層鉄心の両端部の注入用穴部から穴部に沿った端面上を介して注入され穴部内に永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたものである。

【０００９】又、この発明の請求項５に係る磁石埋込型回転子は、請求項４において、積層鉄心の端面上に装填される樹脂部材を各穴部の周方向両端側の位置でそれぞれ隣り合う同士を連結させて環状に形成するようにしたものである。

【００１０】又、この発明の請求項６に係る磁石埋込型回転子は、請求項１ないし５のいずれかにおいて、樹脂部材を熱硬化性樹脂としたものである。

【００１１】

【発明の実施の形態】実施の形態１．以下、この発明の実施の形態を図に基づいて説明する。図１はこの発明の実施の形態１における磁石埋込型回転子の外観を示す斜視図、図２は図１における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図、図３は図２における線ＩＩＩ－ＩＩＩに沿う断面を示す断面図、図４は図１における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図、図５は図４における線Ｖ－Ｖに沿う断面を示す断面図、図６は図１における磁石埋込型回転子の製造に適用される注入金型の構成を積層鉄心が嵌挿された状態で示す断面図である。

【００１２】図において、１は外周近傍の周方向に所定の間隔を介して配置される複数の穴部１ａ、これら各穴部１ａの後述する積層鉄心の中心側の周方向中央部に配置される注入用穴部１ｂ、および中心部に配置される軸用穴部１ｃがそれぞれ形成された第１の板状磁性部材、２はこの第１の板状磁性部材１の各穴部１ａ、１ｂ、１ｃと同様の、穴部２ａ、注入用穴部２ｂ、軸用穴部２ｃ、および穴部２ａと注入用穴部２ｂの間を連通するスリット部２ｄがそれぞれ形成された第２の板状磁性部材である。

【００１３】そして、後述する積層鉄心の両端部および永久磁石とそれぞれ対応する位置に、例えば第２の板状磁性部材２を３～４枚程度、残りの位置には第１の板状磁性部材１をそれぞれ配置した組み合わせで積層し、各穴部１ａと２ａ、１ｂと２ｂ、１ｃと２ｃをそれぞれ一致させ例えば抜きかしめ等で固着一体化することにより積層鉄心３が構成され、第２の板状磁性部材２が配置された部分には各スリット部２ｄにより、板厚の３～４倍分の深さおよび径を有する連通溝部４および連通穴部５が形成される。

【００１４】６は両穴部１ａ、２ａに対をなして嵌挿された永久磁石、７は両軸用穴部１ｃ、２ｃに嵌合された回転子軸、８は各注入用穴部１ｂ、２ｂから注入され、連通溝部４および連通穴部５を介して各穴部１ａ、２ａに注入され、各永久磁石６の軸中心側に一部空間を残して装填された熱硬化性樹脂でなる樹脂部材である。９は積層鉄心３に樹脂部材８を注入するための注入金型で、図５に示すように樹脂供給穴部１０ａ、この樹脂供給穴部１０ａから分岐する分岐穴部１０ｂ、この分岐穴部１０ｂから積層鉄心３の各注入用穴部１ｂ、２ｂと対応する位置で、それぞれ開口される複数の注入穴部１０ｃ、および積層鉄心３の各穴部１ａ、２ａ内の永久磁石６の端面に当接可能な突起部１０ｄを有する上型１０と、積層鉄心３が嵌挿可能な有底穴部１１ａおよび、この有底穴部１１ａの底部の積層鉄心３の各穴部１ａ、２ａと対応する位置にそれぞれ突設され、各穴部１ａ、２ａ内の永久磁石６の端面に当接可能な突起部１１ｂを有する下型１１とで構成されている。

【００１５】次に、上記のように構成される実施の形態１における磁石埋込型回転子の製造方法について説明する。まず、打ち抜き加工により穴部１ａ、注入用穴部１ｂ、軸用穴部１ｃを有する第１の板状磁性部材１、および穴部２ａ、注入用穴部２ｂ、軸用穴部２ｃ、スリット部２ｄを有する第２の板状磁性部材２をそれぞれ形成する。次いで、図４に示すように、第２の板状磁性部材２を積層鉄心３の両端部に相当する位置、および各永久磁石６と対応する位置にそれぞれ３～４枚ずつ配置するとともに、残りの部分には第１の板状磁性部材１を配置し、お互いの穴部１ａ、２ａ、注入用穴部１ｂ、２ｂ、および軸用穴部１ｃ、２ｃがそれぞれ一致するように積層して、例えば抜きかしめ等により固着一体化して積層鉄心３を形成する。

【００１６】次に、上記のようにして形成された積層鉄心３を、図５に示すように各穴部２ａが各突起部１１ｂと一致するように下型１１の有底穴部１１ａ内に嵌挿する。次いで、積層鉄心３の各穴部１ａ、２ａ内にそれぞれ永久磁石６を所定の個数ずつ挿入する。そして、上型１０を各注入穴部１０ｃが積層鉄心３の各注入用穴部２ｂの位置と、各突起部１０ｄが積層鉄心３の各穴部２ａの位置とそれぞれ一致するように下型１１の上部に載置し、図示はしないが締付部により上型１０および下型１１を締め付け固定させた後、所定の圧力により樹脂供給穴部１０ａから樹脂部材８を注入する。

【００１７】すると、この樹脂部材８は上型１０の分岐穴部１０ｂ、各注入穴部１０ｃおよび積層鉄心３の各注入用穴部１ｂ、２ｂ内を順に流れて、図２および図３に示すようにスリット部２ｂによって形成される各連通穴部５を介して各穴部１ａ、２ａ内に導かれ、各永久磁石６を外周側に押圧し軸中心側に一部空間を残した状態

で、また、積層鉄心３の両端部にスリット部２ｂによって形成される各連通溝部４を介して各穴部１ａ、２ａ内に導かれ、永久磁石６をその両側面から押圧した状態でそれぞれ充填される。次に、この状態で加熱することにより樹脂部材８を硬化させて積層鉄心３内に一体化する。次いで、締付部（図示せず）を緩めて上型１０を外し、積層鉄心３を下型１１から取り出して軸用穴部１ｃ、２ｃに、回転子軸７を嵌合させて固着することにより磁石埋込型回転子が完成する。

【００１８】このように上記実施の形態１によれば、樹脂部材８をスリット部２ｄによって形成される各連通溝部４および連通穴部５を介して各穴部１ａ、２ａ内に導き、永久磁石６を外周側に押圧し軸中心側に一部空間を残した状態および永久磁石６の両側面から押圧した状態でそれぞれ装填するようにしているので、永久磁石６をバランス良く確実に固定することができ、信頼性の向上を図ることが可能になる。

【００１９】又、樹脂部材８を連通溝部４および連通穴部５の両方から各穴部１ａ、２ａ内に導くことにより、各永久磁石６の軸中心側に一部空間を形成するようにしているので、この空間が形成されている範囲分だけ積層鉄心３にかかる力を低減することができ、積層鉄心３に過大な力がかかって薄肉部分が損傷したりするのを防止することが可能になる。さらに又、樹脂部材８を熱硬化性樹脂としたことにより、積層鉄心３への一体化が容易となり組立作業性の向上を図ることが可能になる。

【００２０】実施の形態２．図７はこの発明の実施の形態２における磁石埋込型回転子の外観を示す斜視図、図８は図７における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図、図９は図７における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

【００２１】図において、上記実施の形態１におけると同様な部分は同一符号を付して説明を省略する。１２は両端に例えば第２の板状磁性部材２を１～２枚程度、各永久磁石６と対応する位置に第２の板状磁性部材２を３～４枚程度、また、残りの位置には第１の板状磁性部材１をそれぞれ配置した組み合わせで積層し、各穴部１ａと２ａ、１ｂと２ｂ、１ｃと２ｃをそれぞれ一致させ、抜きかしめ等で固着一体化して形成される積層鉄心である。

【００２２】１３、１４は第２の板状磁性部材２が配置された部分に、それぞれ各スリット部２ｄにより板厚の１～２倍分の深さ、および板厚の３～４倍分の径に形成された連通溝部および連通穴部、１５は各注入用穴部１ｂ、２ｂから注入され、連通溝部１３および連通穴部１４を介して各穴部１ａ、２ａに注入され、各永久磁石６の軸中心側に一部空間を残して装填された熱硬化性樹脂でなる樹脂部材で、連通溝部１３を介して装填される部分は、注入金型９の上型１０および下型１１に形成される溝（図示せず）の働きにより積層鉄心１２の端面より外方に突出し、各穴部２ａの周方向両端側の位置でそれぞれ隣り合う同士が連結されて環状に形成されている。

【００２３】このように上記実施の形態２によれば、上記実施の形態１におけると同様に樹脂部材１５をスリット部２ｄによって形成される各連通溝部１３および連通穴部１４を介して各穴部１ａ、２ａ内に導き、永久磁石６を外周側に押圧し軸中心側に一部空間を残した状態および永久磁石６の両側面から押圧した状態でそれぞれ装填するようにしているので、永久磁石６をバランス良く確実に固定することができ、信頼性の向上を図ることが可能になる。

【００２４】又、樹脂部材１５を連通溝部１３および連通穴部１４の両方から各穴部１ａ、２ａ内に導くことにより、各永久磁石６の軸中心側に一部空間を形成するようにしているので、この空間が形成されている範囲分だけ積層鉄心１２にかかる力を低減することができ、積層鉄心１２に過大な力がかかって薄肉部分が損傷したりするのを防止することが可能になる。又、樹脂部材１５を熱硬化性樹脂としたことにより、積層鉄心１２への一体化が容易となり組立作業性の向上を図ることが可能になる。

【００２５】又、積層鉄心１２の両端部側から各穴部１ａ、２ａ内へ、注入金型９の上型１０および下型１１に形成された溝（図示せず）および連通溝部１３を介して導くようにしているので、溝（図示せず）を利用する分だけ連通溝部１３の深さ、すなわち連通溝部１３を形成するために配置される第２の板状磁性部材２の枚数を減らすことができ、原価の低減を図ることができる。さらに又、積層鉄心１２の両端面から突出する樹脂部材１５を、各穴部２ａの周方向両端側の位置でそれぞれ隣り合う同士を連結させて環状としているので、機械的強度の向上を図ることができる。

【００２６】実施の形態３．図１０はこの発明の実施の形態３における磁石埋込型回転子の外観を示す斜視図、図１１は図１０における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図、図１２は図１０における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。図において、上記実施の形態１、２におけると同様な部分は同一符号を付して説明を省略する。１６は各永久磁石６と対応する位置に第２の板状磁性部材２を３～４枚程度、また、残りの位置には第１の板状磁性部材１をそれぞれ配置した組み合わせで積層し、各穴部１ａと２ａ、１ｂと２ｂ、１ｃと２ｃをそれぞれ一致させ、抜きかしめ等で固着一体化して形成される積層鉄心である。

【００２７】１７は第２の板状磁性部材２が配置された部分に、各スリット部２ｄにより板厚の３～４倍分の径に形成された連通穴部、１８は各注入用穴部１ｂ、２ｂから注入され、連通穴部１７および注入金型９の上型１０、下型１１に形成される溝（図示せず）を介して各穴部１ａ、２ａに注入され、各永久磁石６の軸中心側に一部空間を残して装填された熱硬化性樹脂でなる樹脂部材で、溝（図示せず）を介して装填される部分は積層鉄心１６の端面より外方に突出し、各穴部１ａの周方向両端側の位置でそれぞれ隣り合う同士が連結されて環状に形成されている。

【００２８】このように上記実施の形態３によれば、上記実施の形態２におけると同様に、永久磁石６をバランス良く確実に固定することにより信頼性の向上を図り、又、各永久磁石６の軸中心側に一部空間を形成することにより積層鉄心１６にかかる力を低減して過大な力がかかって薄肉部分が損傷したりするのを防止し、又、樹脂部材１８として熱硬化性樹脂を用いることにより、積層鉄心１６への一体化を容易として組立作業性の向上を図ることが可能になるということは勿論、樹脂部材１８の積層鉄心１６両端部側から各穴部１ａ、２ａ内への導入を、金型９の上型１０および下型１１に形成された溝（図示せず）のみにより行うようにしているので、上記実施の形態２におけるような連通溝部１３が不要、すなわち、連通溝部１３を形成するために配置される第２の板状磁性部材２が全く不要となり、大幅な原価低減が可能になる。なお、金型９の上型１０および下型１１に形成される溝の代わりに、上型１０および下型１１の積層鉄心１６の端面とそれぞれ対向する面全体を窪ませ、この窪みによって形成される空間内を介して樹脂部材１８を装填するようにしても良く、この場合、樹脂部材１８は積層鉄心１６の両端全域を覆うように突出して形成されることは言うまでもない。

【００２９】

【発明の効果】以上のように、この発明の請求項１によれば、板状磁性部材を積層して形成された積層鉄心と、積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、各穴部にそれぞれ嵌挿される複数の永久磁石と、各穴部の積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し永久磁石と対応する位置で穴部と連通して形成される複数の注入用穴部と、積層鉄心の両端面に穴部と注入用穴部の間をそれぞれ連通して形成される連通溝部と、注入用穴部および連通溝部を介して注入され穴部内に永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたので、永久磁石をバランス良く確実に固定するとともに、樹脂部材の注入時に積層鉄心にかかる圧力を低減し、信頼性の向上を図ることが可能な磁石埋込型回転子を提供することができる。

【００３０】又、この発明の請求項２によれば、請求項１において、連通溝部を介して注入される樹脂部材を積層鉄心の端面より突出して装填するようにしたので、信頼性の向上を図り得ることは勿論、原価の低減を図ることが可能な磁石埋込型回転子を提供することができる。

【００３１】又、この発明の請求項３によれば、請求項２において、積層鉄心の端面より突出して装填される樹脂部材を各穴部の周方向両端側の位置でそれぞれ隣り合う同士を連結させて環状に形成するようにしたので、原価の低減ならびに機械的強度の向上を図ることが可能な磁石埋込型回転子を提供することができる。

【００３２】又、この発明の請求項４によれば、板状磁性部材を積層して形成された積層鉄心と、積層鉄心の外周近傍に周方向に所定の間隔を介し且つ軸方向に貫通して形成された複数の穴部と、各穴部にそれぞれ嵌挿される複数の永久磁石と、各穴部の積層鉄心の中心側に沿ってそれぞれ軸方向に貫通し永久磁石と対応する位置で穴部と連通して形成される複数の注入用穴部と、注入用穴部および積層鉄心の両端部の注入用穴部から穴部に沿った端面上を介して注入され穴部内に永久磁石の軸中心側に一部空間を残して装填される樹脂部材とを備えたので、信頼性の向上ならびに原価の低減が可能な磁石埋込型回転子を提供することができる。

【００３３】又、この発明の請求項５によれば、請求項４において、積層鉄心の端面上に装填される樹脂部材を各穴部の周方向両端側の位置でそれぞれ隣り合う同士を連結させて環状に形成するようにしたので、信頼性の向上ならびに原価の低減が可能であることは勿論、機械的強度の向上が可能な磁石埋込型回転子を提供することができる。

【００３４】又、この発明の請求項６によれば、請求項１ないし５のいずれかにおいて、樹脂部材を熱硬化性樹脂としたので、組立作業性の向上を図ることが可能な磁石埋込型回転子を提供することができる。

【図面の簡単な説明】

【図１】　この発明の実施の形態１における磁石埋込型回転子の外観を示す斜視図である。

【図２】　図１における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

【図３】　図２における線ＩＩＩ－ＩＩＩに沿う断面を示す断面図である。

【図４】　図１における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

【図５】　図４における線Ｖ－Ｖに沿う断面を示す断面図である。

【図６】　図１における磁石埋込型回転子の製造に適用される注入金型の構成を積層鉄心が嵌挿された状態で示す断面図である。

【図７】　この発明の実施の形態２における磁石埋込型

回転子の外観を示す斜視図である。

【図８】　図７における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

【図９】　図７における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

【図１０】　この発明の実施の形態３における磁石埋込型回転子の外観を示す斜視図である。

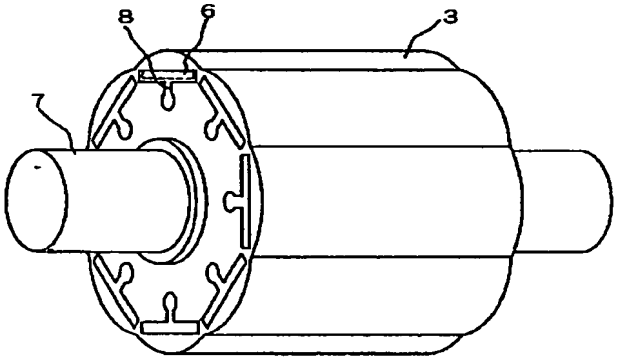
【図１１】　図１０における磁石埋込型回転子の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－＊Ｂに沿う断面を示す断面図である。

【図１２】　図１０における磁石埋込型回転子の積層鉄心の構成を示し、（Ａ）は正面図、（Ｂ）は（Ａ）における線Ｂ－Ｂに沿う断面を示す断面図である。

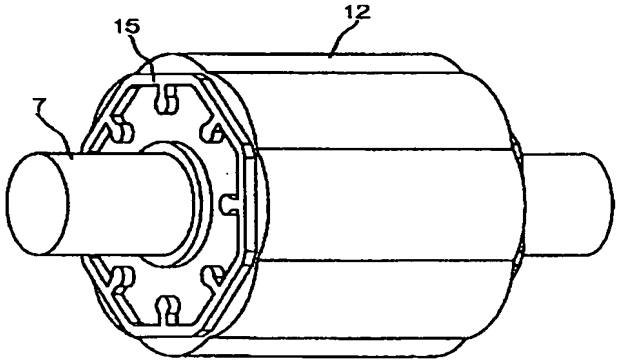
【符号の説明】

１　第１の板状磁性部材、２　第２の板状磁性部材、１ａ，２ａ　穴部、１ｂ，２ｂ　注入用穴部、１ｃ，２ｃ　軸用穴部、２ｄ　スリット部、３，１２，１６　積層鉄心、４，１３　連通溝部、６　永久磁石、７　回転子軸、８，１５，１８　樹脂部材、９　注入金型、１０　上型、１１　下型、５，１４，１７　連通穴部。

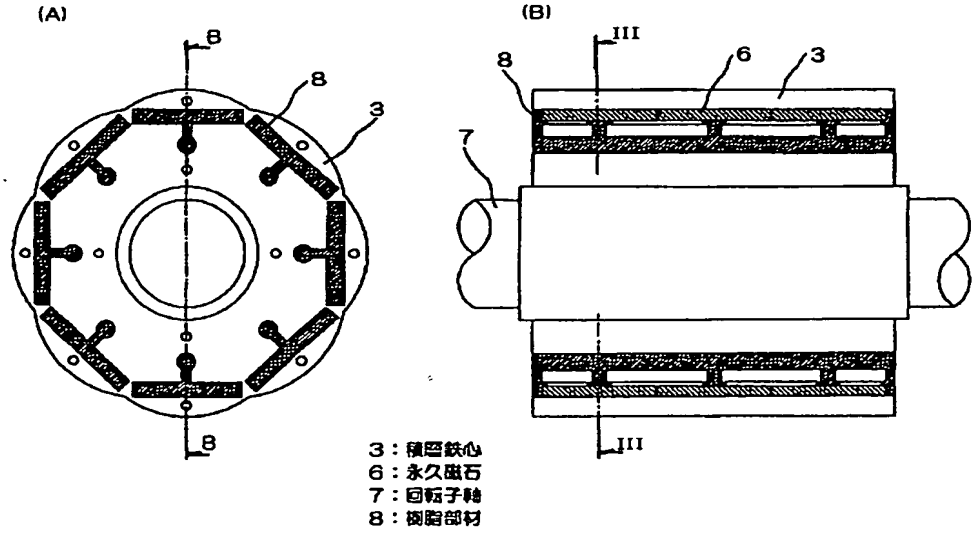
【図１】



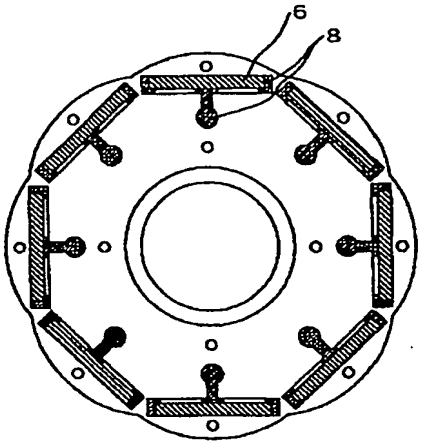
【図７】



【図２】

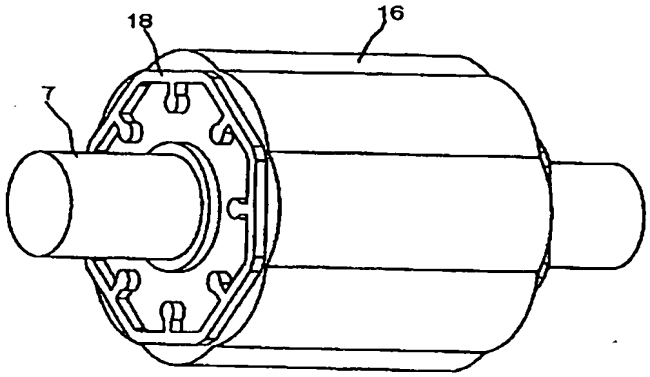


【図３】



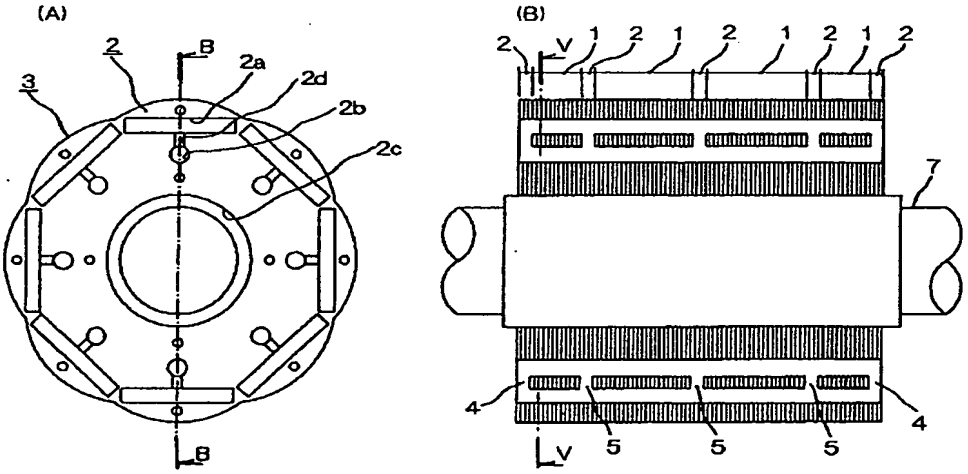
６：永久磁石
８：樹脂部材

【図１０】



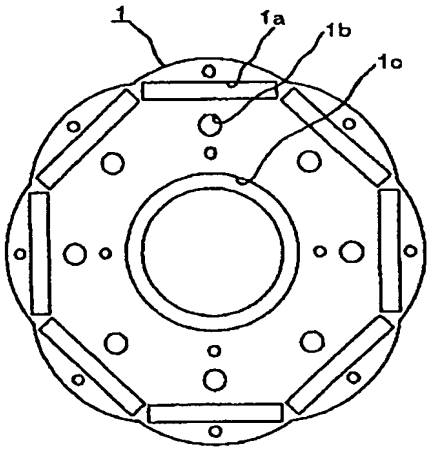
７：回転子軸
１６：積層鉄心
１８：樹脂部材

【図４】



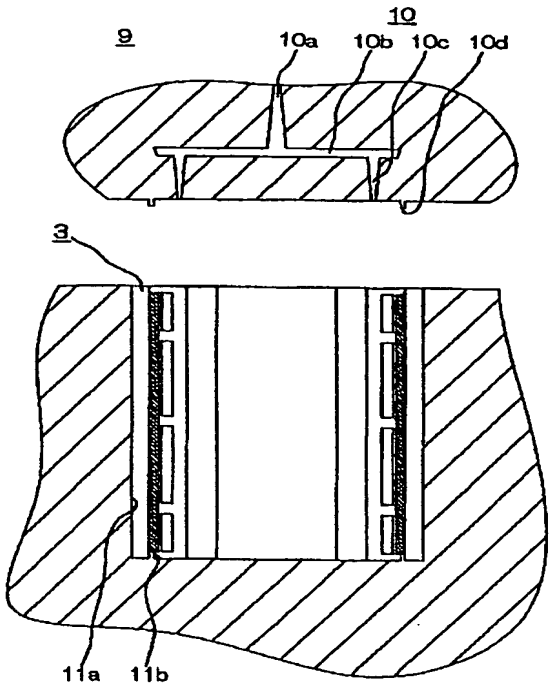
１：第１の板状磁性部材
２：第２の板状磁性部材
２ａ：穴部
２ｂ：注入用穴部
２ｃ：軸用穴部
２ｄ：スリット部
３：積層鉄心
４：連通溝部
５：連通穴部
７：回転子軸

【図５】



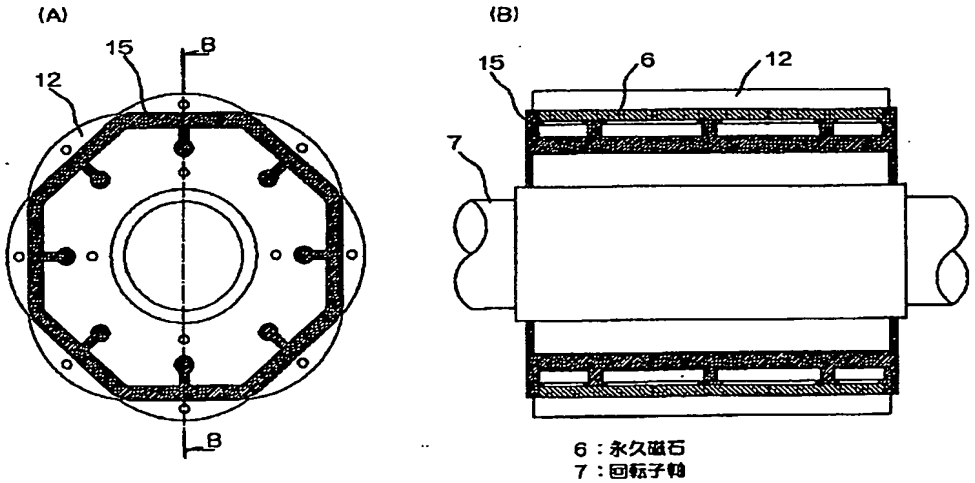
１：第１の板状磁性部材
１ａ：穴部
１ｂ：注入用穴部
１ｃ：軸用穴部

【図６】



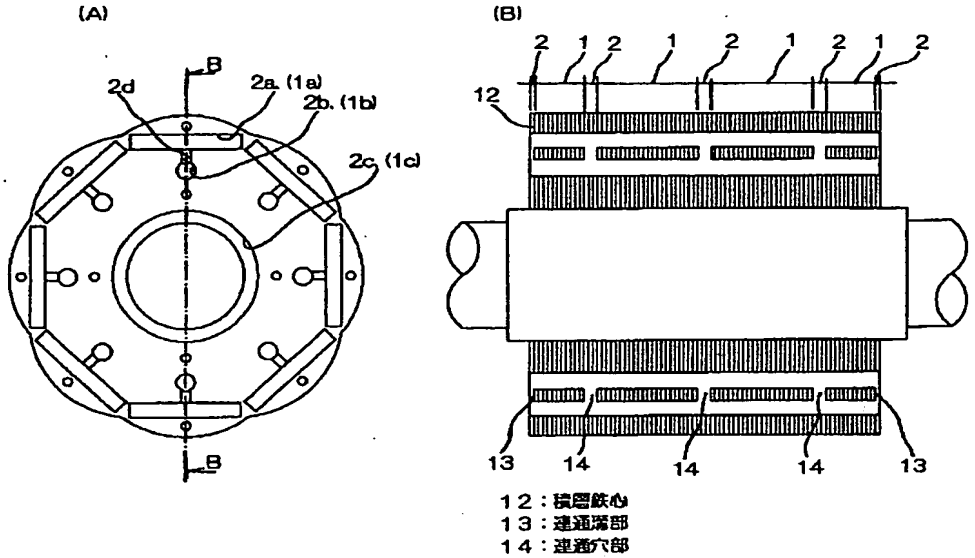
３：積層鉄心
９：注入金型
１０：上型
１１：下型

【図８】

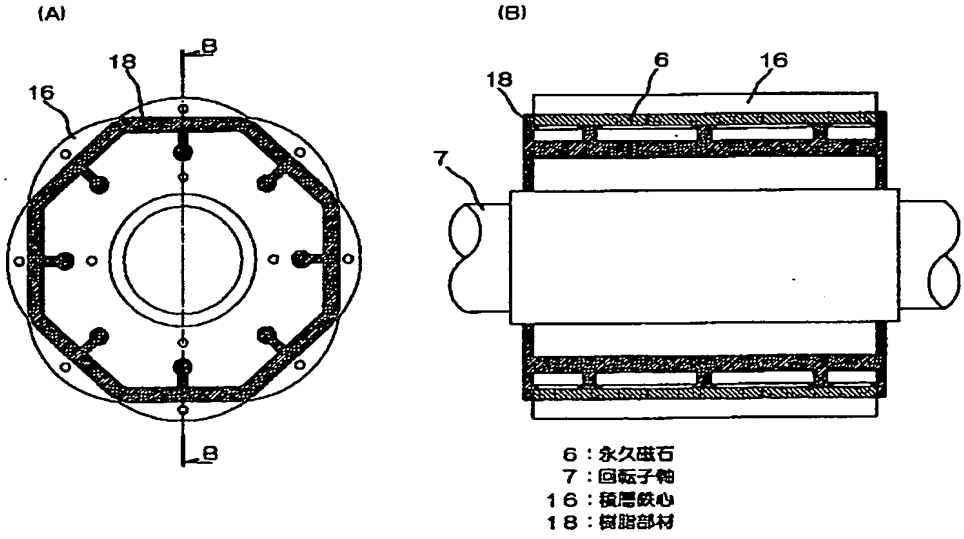


６：永久磁石
７：回転子軸
１２：積層鉄心
１５：樹脂部材

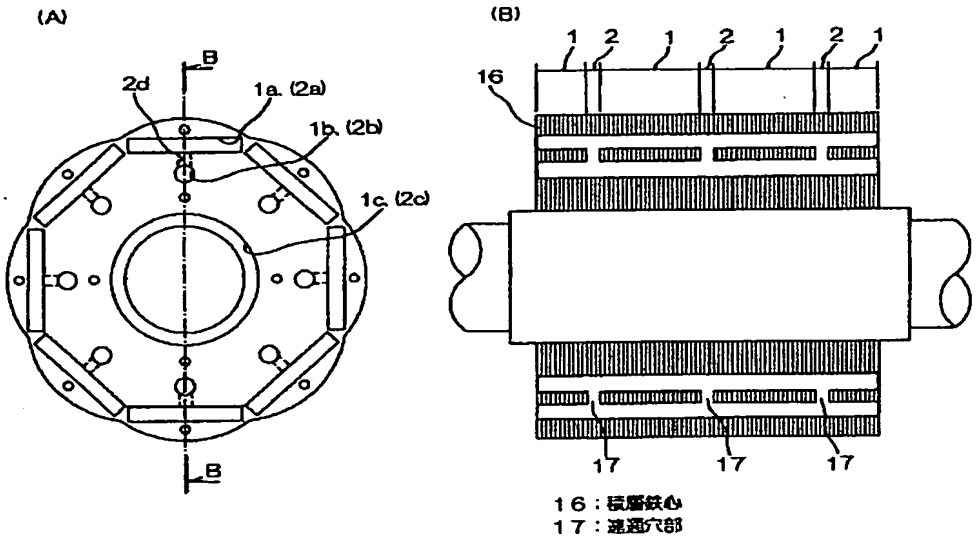
【図９】


(A)
(B)
B
2d
2a (1a)
2b (1b)
2c (1c)
B
2 1 2 1 2 1 2 1 2
12
13 14 14 14 13
１２：積層鉄心
１３：連通溝部
１４：連通穴部

【図１１】


(A)
(B)
B
18
16
B
6
16
18
7
６：永久磁石
７：回転子軸
１６：積層鉄心
１８：樹脂部材

【図１２】



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